The Evolution of Household Income Volatility

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Abstract

We find that the volatility of household income—as measured by the standard deviation of two-year percent changes in income—increased one-third between the early 1970s and early 2000s. Based on data from the PSID, the rise in volatility represented an upward trend throughout the past thirty years and occurred within each major age and education group. The rise stemmed primarily from an increasing frequency of very large income changes rather than larger changes throughout the income distribution. We estimate notable increases in the volatility of both labor earnings and transfer income, and we show that the volatility of earnings per hour rose more than the volatility of hours worked.

1. Introduction

The aggregate U.S. economy has been markedly more stable since the mid-1980s than it had been in the preceding couple of decades. The reduction in volatility is widespread, showing up in real GDP and most of its components as well as other measures of economic activity. The source of this "Great Moderation" has been the subject of considerable debate, with various papers arguing that volatility fell principally because of milder economic shocks, better monetary policy, improved inventory management, or financial innovation.

In contrast with the well-documented stabilization of the aggregate economy, no consensus exists about the evolution of volatility for individual households and firms. Although the Great Moderation might suggest that individual economic circumstances have also moderated, many commentators argue that globalization, deregulation, and technological change have increased creative destruction and that this more dynamic economy heightens the competitive pressures and uncertainties faced by workers and firms. Empirical analysis has been inconclusive. On the household side, Gottschalk and Moffitt (1994, 1995, 2002, and 2006), Dynarski and Gruber (1997), Haider (2001), and others estimated that individual labor earnings have become more volatile during the past few decades, and Hacker (2006) asserted the same for family income. However, the Congressional Budget Office (2007) found that individual earnings volatility has changed little since 1980. On the firm side, Comin and Philippon (2005) and Comin and Mulani (2006) estimated that business performance has became more volatile as well, but Davis, Haltiwanger, Jarmin, and Miranda (2006) found that the volatility of firms' sales and employment growth has declined over time.

This paper examines the evolution of household income volatility using data from the Panel Study of Income Dynamics (PSID). To make the analysis as transparent as possible, we do not estimate a formal model of income but simply document changes over time in the cross-sectional distribution of income changes. We carefully investigate, and correct for, measurement problems in the data. We also explore the evolving volatility and correlations of movements in various components of income and the evolving volatility of related characteristics such as hours worked and earnings per hour.

To summarize our results, we estimate that the volatility of household income—as measured by the standard deviation of two-year percent changes in income—increased one-third between the early 1970s and early 2000s. This finding contrasts sharply with the nearly one-half *decline* in the volatility of aggregate income between the 1960-1983 and 1984-2004 periods. The rise in volatility did not occur in a single period but represented an upward trend throughout the past thirty years; it occurred within each major education and age group as well. Yet, the run-up in volatility was concentrated in one important sense: It stemmed primarily from an increasing frequency of very large income changes rather than larger changes throughout the distribution.

Turning to the components of income, we estimate notable increases in the volatility of labor earnings and transfer income and a small increase in the volatility of capital income. Household earnings became more volatile even though the volatility of individual earnings stayed roughly constant. The explanation is that women's earnings became less volatile while men's earnings became more volatile, and the latter matters more for household earnings because men earn more than women on average. We show that rising volatility in men's earnings owes more to rising volatility in earnings per hour

than in hours worked. And we demonstrate that earnings shifts between household members, as well as shifts in market income and transfer income, provide only small offsets to each other.

The limitations of our analysis bear emphasis. First, an increase in the *volatility* of household income does not imply a corresponding increase in *risk*. Our calculations distinguish only slightly between voluntary and involuntary changes in income, they do not include shocks to desired spending, and they do not account for adjustments to saving and borrowing that can buffer income shifts. We are currently investigating these issues in related research on the evolving volatility of household spending. Second, our analysis includes only households whose heads are 25 years or older and who are not yet retired. Therefore, we have nothing to say about developments among the youngest and oldest households. Third, our findings are based on a particular methodology applied to a single dataset. Further research using different techniques and datasets will be needed before economists can have a high degree of confidence in the facts about household income volatility. Still more work will be needed to provide economic explanations for those facts and to consider the possible implications for economic policy.

The next section of the paper briefly discusses how we measure volatility using PSID data. Subsequent sections present our results on the evolution of volatility of individual labor earnings, of the components of household income, of household income, and of hours worked and earnings per hour. A final section concludes.

2. Measuring Volatility in the PSID

The PSID contains information about the income of a large set of households between 1967 and 2004, as well as information on their employment and demographic characteristics. Linking all of these data correctly over time is very labor-intensive, because the survey methodology and the definition and construction of variables have changed considerably. In this section we briefly describe the data we use and the algorithm with which we measure volatility.

PSID Data

Households (dubbed "family units" by the PSID) are composed of people living together who are related by blood, marriage, or adoption—or living together permanently and sharing income and expenses. When households are headed by a man and a woman, the PSID labels the man as the household head and the woman as his spouse; when households are headed by a woman alone, she is the head. Data were collected annually through 1996 and biannually thereafter, so we examine two-year changes in income. We deflate nominal dollars into real 2002 dollars using the CPI for urban consumers.

We drop observations where the head is under age 25, to avoid most transitions between school and work, and observations where the head is retired, to stay clear of transitions between work and retirement. We exclude income changes of people moving between households. For example, when a two-earner couple divorces, we account for the loss of the wife's income to the husband (because he remains head of his household) but do not capture the change in the wife's economic circumstances (because her new household, while typically added to the sample, did not exist previously). In addition, we drop observations where the head has changed from the previous observation.[1] For

[1] Our estimates do not control for changes in households' age or food needs (a variable estimated by the PSID staff based on demographic characteristics). Because we are interested in the evolution of overall

analysis of labor earnings, we also drop observations where farm income is positive because such income is not reported comparably over time.[2]

Our analysis focuses on the sub-sample of the PSID that was chosen in 1967 to be representative of the U.S. population and now includes both the original households and new households spun off them. The PSID also covers special samples of low-income households (since 1967), immigrants (since 1997), and Latino households (between 1990 and 1995). Including these households in our analysis would be ideal because of the greater breadth of coverage, larger sample at the bottom of the income distribution, and the existence of population weights that adjust to reflect demographic changes in the country. However, some of the variables we need are not reported for a broader sample in some years or are available only in lower-quality form, so we do not include observations from these special samples. In any event, when we examined household head labor earnings at an earlier stage of the project, we found little difference in volatility between the representative sample and the weighted full sample.

Top-coding in the PSID can distort estimates of volatility: Variables top-coded at the same level in consecutive readings will appear more stable than they really are, and changes in the level of top-coding can affect the reported evolution of income in spurious ways. For each variable, we identify the year with the maximum share of the sample that is top-coded—for example, about ½ percent for total income—and drop that same share

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income volatility, we do not want to exclude changes caused by compositional shifts. More broadly, changes in food needs are just one shock to desired consumption; measuring the evolution of all risks on the spending side of household budgets would be an important extension of this paper.

[2] The PSID's variables for total labor earnings included the labor parts of farm and business income through the 1993 survey but not afterwards. The labor part of farm income is not provided after the 1993 wave, so we drop the affected observations. The labor part of business income is provided separately beginning with the 1994 survey, so we add it back into total labor earnings. However, the PSID's algorithm for splitting business income into labor and capital income has changed over time, so achieving perfect consistency is not possible.

of observations from the top of the distribution in all years. In addition, some variables have been bottom-coded at $1 in some years. For consistency over time and across variables, we replace any value of $0 or below with $1.

PSID data include a significant amount of measurement error, so one should not take our estimates of the *level* of volatility literally. However, the crucial question for evaluating *changes* in volatility is whether measurement error has changed over time. In fact, the PSID implemented two major methodological changes in the early 1990s, as described by Kim, Loup, Lupton, and Stafford (2000) and Kim and Stafford (2000). Income data for 1992 and later were collected using Computer Assisted Telephone Interviewing rather than traditional paper questionnaires, and income data for 1993 and later were processed using different software. Kim et al warned that these shifts create a "potential double seam" in the data, and we return to this issue shortly.[3]

Measuring Volatility

Gottschalk and Moffitt's seminal papers on labor earnings measured volatility as the magnitude of transitory earnings, which they calculated in two ways—as earnings less a moving average of earnings, and as derived from time-series decompositions of earnings. These studies yielded important results that we review later.[4]

In this paper, though, we measure volatility using the magnitude of total changes in income rather than trying to isolate the transitory components of those changes. We view our approach as a significant complement to the Gottschalk-Moffitt procedure for

[3] The PSID family files for some recent years are available only in "early release" form, implying that some of the data have undergone limited processing and that some variables are not included. Other variables are released through the supplementary "Income Plus" files, which we use.

[4] Distinguishing between permanent and transitory movements in income is crucial for many purposes. For example, Carroll and Samwick (1997) emphasize this distinction in their tests of the buffer-stock model of consumption and saving.

three reasons: First, at this early point in research on the evolution of household income volatility, documenting the facts in the least processed and filtered manner is valuable. We count it a virtue that our results do not depend on a particular model of income dynamics or a particular estimate of underlying income. Second, understanding the full changes in income experienced by households is as useful and necessary as understanding the transitory movements. Third, the comparative simplicity of our technique allows us to explore measurement issues in the data, the evolving volatility and correlations of movements in various components of income, and the evolving volatility of related characteristics such as hours worked and earnings per hour.

To summarize the magnitude of income changes experienced by the population in each year, we calculate the cross-sectional standard deviation of percent changes in income.[5] Most research on the volatility of individuals' earnings has reported variances rather than standard deviations, because the additive nature of variances is crucial to the goal of parsing volatility into permanent and transitory components. Yet, this additive property is not needed to describe changes in volatility over time, and volatility described in terms of squared growth rates is difficult to interpret. An economy with three households experiencing income changes of 20 percent, -20 percent, and 0 percent would have a standard deviation of income changes equal to 16 percentage points, measured in the same units as income growth and comparable to it. If these changes become +30, -30, and 0, the standard deviation rises to 24 percentage points, a 50 percent increase that sensibly characterizes the increase in economic turbulence. However, the variance of

[5] Because we analyze percent changes rather than levels of income, no further scaling is needed to maintain comparability over time.

income changes rises from 266 to 600 percentage points squared; neither these levels nor the 125 percent increase between them is easy to interpret.

We calculate percent changes as $100*(Y_t-Y_{t-2})/Y_{average}$ with $Y_{average} = (Y_t+Y_{t-2})/2$. This formula has two advantages over simple percent changes: It is symmetric regarding increases and decreases, and it naturally bounds the results between 200 and -200 percent.[6] More generally, percent changes are easier to understand than other transformations and, under the common assumption that utility displays constant relative risk aversion, a given percent change corresponds to the same relative change in utility regardless of the absolute change. We experimented with simple percent changes and with scaling changes by the average levels of the previous three years; the results were similar qualitatively but somewhat different quantitatively.[7]

Neither this paper nor previous ones on the volatility of earnings and income distinguish effectively between voluntary and involuntary changes.[8] For example, we do not separate people whose earnings decline because they choose to cut back to part-time

[6] Davis, Faberman, and Haltiwanger (2006) used this formula to calculate percent changes in employment.

[7] We also considered other options. First, we thought about analyzing deviations relative to a moving-average level (as done by Gottschalk and Moffitt) rather than analyzing changes. But a return of income to its previous long-run level represents stability in that calculation and volatility in ours—and the latter seemed more appropriate. Second, we considered scaling income changes by the levels of income predicted by households' demographic characteristics. However, this approach is less transparent than ours, and households presumably care about income movements relative to their previous income rather than an econometrician's prediction of their income. Third, we could have replaced our formula for percent changes with logarithmic changes, but this would also have been less transparent. Fourth, we thought about using a more complex transformation in order to give weight to the absolute change as well as the percent change. Carroll, Dynan, and Krane (2003) noted that "effects [of risk on wealth] estimated using logs could give undue weight to responses at the lower end of the wealth distribution" (page 592), and they transformed wealth using the inverse hyperbolic sine function instead. However, this approach would lose the clarity and simplicity of percent changes. In addition, it is not obvious that a decline from $1000 to $1 is less troublesome than a decline from $100,000 to $10,000, especially because we are studying income rather than consumption and because the PSID incorporates transfer income.

[8] Cunha and Heckman (2007) decompose the increase in earnings inequality during recent years into a component that is predictable by individuals and a component that is not. They find increases in both components, with the rise in the unpredictable component especially pronounced for less-skilled workers.

work from those whose earnings decline because they lose full-time jobs and can find only part-time new jobs. We return to this issue near the end of the paper.

3. Volatility of Individual Labor Earnings

Labor earnings—defined in the PSID to include wages and salaries, overtime pay, bonuses, commissions, and a portion of self-employment income determined by the PSID staff—are the largest component of income for most households. In this section we consider earnings at the individual level; in the next sections we address earnings and other components of income at the household level.

Volatility of Household Heads' Earnings

In preliminary analysis of the data we noticed a sharp jump during the early 1990s in the number of household heads reporting zero earnings followed and preceded by substantial earnings. These sequences generate very large earnings gains and declines, so the step-up in their frequency significantly raises the estimated volatility of earnings during the past fifteen years.

However, the step-up in the probability of zero earnings sandwiched between substantial earnings appears to reflect changes in measurement rather than changes in the economic environment. First, the coincidence of timing with the PSID methodological changes noted earlier is striking. Second, identifying changes in economic conditions that would have had such a large and sudden effect is difficult. Third, we see no evidence of other outcomes that would be expected if economic conditions had become much more turbulent at that time: There is no reported change in the frequency of zero earnings following or preceding *low* earnings or in the frequency of zero earnings right

before or after substantial earnings for *spouses*. Fourth, and most persuasive, the top left panel of figure 1 shows that the percentage of household heads recorded as having zero labor earnings in a year despite working more than 120 hours jumped immediately after 1991, which is the last year of income data preceding the changes in the PSID. This combination almost certainly signals an error in either reported hours or reported earnings; in the latter case, it generates a spurious drop in earnings and rebound in the subsequent year of just the sort we observe. The frequency of such observations stays high through 2002 and then falls back in 2004, the last year of the sample.

To assess the evolution of true economic volatility, the remainder of our analysis excludes the apparently spurious observations with household heads' earnings of zero and hours worked over 120.[9] The role of this exclusion can be seen in the top right panel. For each year we calculate the standard deviation across household heads of the percent changes in their earnings (as defined earlier) during that year and the preceding two years; the rolling calculation reduces the choppiness that can arise with small sample sizes. For all observations, shown with the dashed line, volatility by this measure increased 54 percent between the early 1970s and early 2000s. Excluding the spurious observations, shown with the solid line, volatility rose 39 percent during this period.[10] These changes are shown in the top lines of table 1, which also presents comparable numbers for other categories of earnings and income that we discuss shortly.

[9] One alternative is to replace any level of reported earnings below a threshold value with the threshold value itself (as Winship, 2007, does for household income). However, the observations of zero earnings are generally bracketed by earnings over $10,000, so even a substantial threshold leaves a marked rise in large earnings movements in the early 1990s. Other alternatives are to drop all observations with the head's earnings equal to zero or, when we turn to household income, observations with total earnings equal to zero. However, the former drops more observations than needed, and the latter does not drop enough because positive earnings by a spouse can mask misleading reports of zero earnings by a head.

[10] The probability of very large movements in earnings is related to business-cycle conditions. Large declines were more common during recessions, and large increases were more common during booms.

Volatility of Spouses' Earnings

In contrast with the rise in earnings volatility for household heads, the volatility of spouses' earnings declined during the past thirty years. As shown in the bottom left panel, the standard deviation of percent changes in earnings of spouses moved down 16 percent between the early 1970s and early 2000s. Still, the volatility of earnings remains higher for spouses than for heads.

Volatility of Heads' and Spouses' Pooled Earnings

The bottom right panel of figure 1 displays the volatility of earnings for the pooled sample of household heads and spouses in the PSID. The volatility of earnings edged down, on balance, during the past thirty years, as depicted by the solid line. Volatility rose for males (the dashed line) but fell for females (the dotted line). This split by gender is consistent with the patterns shown in the previous panels for household heads (who are mostly men, given the PSID's labeling convention) and spouses (who are all women, for the same reason).[11]

Comparison with Results in CBO (2007)

CBO (2007) analyzed the evolution of labor earnings volatility using the Continuous Work History Sample (CWHS) of the Social Security Administration. These data are based on administrative records rather than a survey; they cover individual workers rather than families and include no information except for earnings, age, and gender. CBO reported that the standard deviation of percent changes in earnings declined a little between 1980 and 2003 for all workers, with similar declines observed for both

[11] The volatility of earnings for male heads increased over time, while the volatility of earnings for female heads was roughly unchanged.

men and women.[12] The CBO finding for all workers is fairly close to ours, but that for men differs noticeably. Because rising male earnings volatility matters a good deal for our estimate of the volatility of household income, the contrast deserves attention.

One possible source of this difference is that CBO analyses one-year changes, while the limitations of the PSID force us to study two-year changes. Shifts in the persistence of income shocks might cause volatility at the two-year horizon to evolve differently from volatility at the one-year horizon.

Another difference is that we include self-employment earnings, and CBO does not. Because we are ultimately interested in total household income, we use the most inclusive measure of earnings available. Whether excluding self-employment earnings raises or lowers volatility is unclear: Such earnings are likely more volatile than wages and salaries, but they also tend to be negatively correlated with them—for example, as individuals turn to self-employment when they lose their jobs, a transition reported by Fairlie (2005) to occur often. More important for this analysis, excluding self-employment earnings appears to damp somewhat the rise in volatility over time: When we drop household heads who report having a financial interest in a business (which removes about 15 percent of the sample) we find that volatility of heads' earnings rises 13 percent since 1980 compared with 19 percent in the baseline sample.[13]

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[12] CBO also reported that earnings volatility was little changed between 1960 and 1980 for workers in the bottom two quintiles of the earnings distribution; earnings in higher quintiles sometimes exceeded the maximum level taxed by Social Security before 1980 and therefore could not be included in the analysis.

[13] In addition, because more men than women are self-employed, self-employed earnings likely have a bigger effect on earnings volatility for men than for women, which is consistent with the difference between our result and CBO's. Excluding people with business interests might reduce the uptrend in volatility not because their self-employment earnings became more volatile but because their wages and salaries did—which should be picked up by CBO's approach. However, there is no reason to think this is so. In any event, this alternative interpretation cannot be tested effectively, because previous research has generally distrusted survey responses separating self-employment earnings from other earnings. Fairlie (2005) found that "more than half of the self-employed with positive earnings in the [National Longitudinal

A third difference is that CBO includes all workers who are 22 years or older, while we include only household heads who are 25 years or older, and their spouses, to stay clear of transitions between school and work. Therefore, our estimates exclude the roughly 15 percent of the work force represented by people who are not a household head or spouse, or whose household head is younger than 25 years.[14]

A fourth difference involves the calculation and top-coding of percent changes. Our formula treats increases and decreases symmetrically, and it generates no changes exceeding 200 percent in absolute value. CBO's formula is not symmetric. It also caps all increases from zero earnings at 100 percent (say, from $0 to $1000) but allows other increases up to 1000 percent (say, from $100 to $1000) and drops increases larger than 1000 percent (say, from $100 to $1100).

A final significant difference between the studies is the datasets used. Although one might view the CWHS administrative data as more accurate for wages and salaries than the PSID survey data, this presumption could be incorrect. Bound and Krueger (1991) took administrative data as the benchmark for examining measurement error in surveys, but Bound, Brown, Duncan, and Rogers (1994, page 357) were more skeptical: "Part of the reason that Bound and Krueger find larger errors than we do has to do with errors in the social security record and part has to do with [Current Population Survey, CPS] recording errors. … We expected that the problems would be mostly with CPS reports; in fact in 15 of 26 cases [with the largest discrepancies] it was one of the SSA

Survey of Youth] report wage and salary income, but do not report business income." Similarly, Holtz-Eakin, Rosen, and Weathers (2000) appeared to use total labor earnings when studying the self-employed in the PSID. A further complication is that the PSID staff divides survey respondents' self-employment income between labor earnings and capital income. Any misallocation will distort measured labor earnings, but not total household income.

[14] Our estimates of household income volatility include the labor earnings of all household members, but for individual earnings volatility we focus on heads and spouses because their earnings are usually larger.

reports that seemed 'out of line.'" Moreover, for self-employment earnings, where tax evasion may be substantial, it is not at all clear whether the CWHS or PSID provides more accurate information.

Comparison with Results in Gottschalk-Moffitt Papers

Gottschalk and Moffitt launched the recent literature on earnings volatility (1994) and returned to the topic several times (1995, 2002, 2006), employing both a formal model of earnings dynamics and a less formal decomposition of earnings movements into permanent and transitory shocks. In all of these papers, they use the PSID to study wages and salaries received by male (or white male) household heads between the ages of 20 and 59. Their latest estimates showed an increase in transitory variance in the early 1980s, a further increase in the early 1990s, a sharp retrenchment in the late 1990s, and finally a large estimated rise in the early 2000s. All told, they concluded that the standard deviation of transitory earnings nearly doubled between the early 1970s and early 2000s, a much larger rise than we find.

The sources of this difference are unclear, as the analysis by Gottschalk and Moffitt differs from ours in several significant ways. They include younger household heads than we do, and they employ an upper cutoff based on age rather than whether household heads say they are retired. They also utilize a narrower definition of labor earnings, and they make no adjustment for the measurement problems we document. Moreover, they focus on formal modeling of earnings dynamics rather than simply tabulating earnings changes as we do; although formal modeling provides benefits, it comes at the cost of greater complexity and makes comparing results more difficult.

Comparison with Other Results on Individual Earnings Volatility

Table 2 summarizes selected studies on the evolution of earnings and income volatility. Most research on individual earnings volatility has concluded that volatility increased considerably during the past several decades, although the timing and magnitude differ across papers, and not all studies agree that volatility has increased. Determining the sources of these differences is difficult owing to the wide range of empirical techniques used and the variety of choices made about which individuals and types of income to analyze.

4. Volatility of Components of Household Income

This section examines, in turn, household labor earnings, capital income, and transfer income.

Heads' and Spouses' Combined Earnings

The top left panel of figure 2 depicts the evolving volatility of the combined labor earnings of household heads and their spouses. The standard deviation of percent changes in combined earnings rose 28 percent between the early 1970s and early 2000s, as reported in table 1. Yet, we showed earlier that the volatility of earnings for the pooled sample of heads and spouses as individuals stayed roughly constant. What explains this combination of results?

The increase in women's labor force participation is not the answer. Consider a household with a husband in the labor force and his wife out of the labor force. If the wife enters the labor force with the same earnings distribution as her husband, then the average volatility of individual earnings rises (because the wife's earnings previously had been perfectly stable at zero) but the volatility of household earnings falls in percentage

terms (because the wife's earnings buffer shocks to her husband's earnings unless the two are perfectly positively correlated). Therefore, this scenario works in the opposite direction of our finding that household earnings volatility rose relative to individual earnings volatility.

Our results about earnings also are not explained by changes in the correlation of earnings of household heads and their spouses. It might be expected that an individual would try to adjust his or her earnings to buffer changes in a partner's earnings—for example, by taking a more demanding job if a partner lost a job, or by shifting toward home production if a partner's earnings rose significantly. At the same time, adults in the same household may face some of the same earnings shocks—for example, changes in economic conditions for workers in certain regions, industries, or occupations. The strength of these forces might well vary over time. For example, Warren (2005) argued that the rise in two-earner families has reduced people's scope for getting a job when their partners' earnings falter; others might speculate that the rise in two-earner families makes it easier for people to work more hours when their partners' earnings falter.

In fact, the correlation of movements in household heads' and spouses' earnings seems to have stayed fairly close to zero throughout the past thirty years. For every decline in a head's earnings exceeding 10 percent, we calculate the share of the decline offset by an increase in the spouse's earnings. As shown in the top right panel of figure 2, the average offset to such significant earnings declines has oscillated over time but has never been very large and shows little trend during our sample period.[15] We find similar results for the average offset to *increases* in heads' earnings and for the *frequencies* with

[15] To reduce the impact of extreme outliers, this figure drops the top and bottom one percent of offsets.

which decreases and increases in head's earnings occurred in conjunction with offsetting changes in spouses' earnings.[16]

Instead, the volatility of combined head and spouse earnings increased while the volatility of individual earnings did not because of the different trends for heads and spouses. Here's why the different trends matter: When calculating volatility for individuals, each person's percent change in earnings receives the same weight regardless of the dollar change in their earnings. But when calculating volatility for households, each person's dollar change in earnings is added to his or her partner's dollar change to obtain the change for the household as a whole. Among two-earner couples in our sample, spouses earn less than half what heads earn on average, so they get less weight in household volatility. The existence of one-earner couples reinforces this point. In a world with one two-earner couple and one one-earner couple, the single head's earnings receive a one-third weight in individual volatility and a one-half weight in household volatility. Indeed, if we estimate individual earnings volatility by weighting percent changes by earnings levels, volatility trends up along with the volatility of combined head and spouse earnings.

Capital Income

Capital income in the PSID equals total income from market sources (which the PSID labels "taxable income") less labor earnings; it excludes capital gains. The solid line in the bottom left panel shows that the volatility of household heads' and spouses' combined capital income rose 9 percent between the early 1970s and early 2000s.

[16] At least two previous studies used PSID data to carefully investigate the relationship between earnings of household members. Focusing on the 1979-95 period, Hyslop (2001) estimated that wives' earnings were positively correlated with their husbands' earnings in both preceding and successive years. In contrast, Shore (2006) concluded that innovations to husbands' and wives' permanent earnings were slightly negatively correlated, on balance, between 1968 and 2001.

Transfer Income

Transfer income in the PSID includes monetary transfers but excludes in-kind transfers. The dashed line in the bottom left panel shows that the volatility of transfers received by household heads and spouses rose 31 percent over the past thirty years, with the biggest increases in the 1970s and early 1990s.[17]

One might expect that shifts in transfer income would be negatively correlated with shifts in income from market sources—because transfers act as a safety net when market incomes decline, because people earn more market income when public benefits decline, or both. The strength of these effects might change over time, for example because of changes in eligibility rules for transfer programs. However, the PSID data suggest that shifts in market income and transfer income tend to provide only small offsets to each other, and that the degree of offset shows little trend. For every decline in market income exceeding 10 percent, we calculate the share of the decline offset by an increase in transfer income. As shown in the lower right panel, the average offset has been around 8 percent and has deviated appreciably from that mark only in the late 1990s.[18] Again, we find similar results for the average offset to increases in market income and for the frequencies with which decreases and increases in market income were combined with offsetting changes in transfer income.

5. Volatility of Household Income

[17] We could find no evidence that the dynamics of reported transfer income or reported capital income were affected by the methodological changes in the PSID. There are no notable shifts in the tails of the distributions, no sudden change in the frequency of very large increases and decreases, and no sudden change in the frequency of zero values.

[18] To reduce the impact of extreme outliers, we again drop the top and bottom one percent of offsets.

Total household income, labeled "total money income" in the PSID, equals the combined labor earnings, capital income, and monetary transfer income of the head and spouse, as well as the income of other household members. After-tax income is not available consistently in the PSID, so we examine pre-tax income; as a reminder, we study only households with heads age 25 or older and not retired.

The volatility of total household income increased about one-third between the early 1970s and early 2000s, as shown in the top left panel of figure 3. The rise was not concentrated in a single period but represented an upward trend throughout the past thirty years. Thus, the standard deviation of percent changes in household income averaged 0.37 in the 1970s, 0.40 in the 1980s, 0.45 in the 1990s, and 0.47 in the 2000s. The overall rise in volatility during our sample period was 36 percent, as shown in table 1.

The run-up in income volatility can be seen in each major education group, as depicted in the upper right panel and in table 1. Because the increase in volatility was about the same for all groups, their relative volatilities have not changed over time: Households whose head does not have a high school degree have consistently experienced more volatile income than households whose head has a high school degree but no college degree, and those households in turn have had slightly more volatile income than households whose head has a college degree. Similarly, and not shown, income volatility increased for households in each major age group. Between the early 1970s and early 2000s, the standard deviation of percent changes in income rose from 0.37 to 0.50 (36 percent) for households whose head is under 35 years old, from 0.33 to 0.46 (42 percent) for households whose head is between 35 and 54 years old, and from 0.38 to 0.46 (22 percent) for households whose head is 55 years or older. The similarity

in levels and changes of income volatility for households in different age groups suggests that shifts in the age composition of the population are not a principal cause of the moderation in aggregate economic activity (contrary to the provocative analysis by Jaimovich and Siu, 2007).

In one important sense, though, the increase in the volatility of household income was more concentrated: The distribution of percent changes in income did not widen uniformly, but principally in the tails. The solid line in the bottom left panel drops the top and bottom ten percent of changes in each year; the resulting standard deviation rises 23 percent over time compared with 36 percent for the complete data. Going further, the dashed line drops the top and bottom quarter of percent changes in each year; here, the standard deviation moves up just 11 percent. Thus, the increase in income volatility occurred partly because small income shifts were replaced by medium shifts, but more because large income shifts were replaced by very large shifts.

The bottom right panel confirms this observation by showing a pronounced increase in the frequency of very large income changes. The share of households experiencing a 50 percent plunge in income over a two-year period (with percent changes calculated as described above) climbed from less than 6 percent in the early 1970s to more than 10 percent in the early 2000s. The share experiencing a 50 percent jump also seems to have trended up, although the series is volatile, and the last two observations fell back a good deal. Note also that weak aggregate economic activity—the shaded bars denote recessions—generates an increase in the frequency of very large household income declines and a decrease in the frequency of very large income gains.

Comparison with Previous Results on Household Income Volatility

Relatively little research has explored the evolving volatility of household income. Table 2 summarizes this work, and we review it briefly here.

A few studies have used data from the PSID. In an analysis of income mobility that used the Gottschalk-Moffitt decomposition, Gittleman and Joyce (1999) estimated that the variance of transitory household income increased between the 1968-79 and 1980-91 periods. Batchelder (2003) examined the variation in households' incomes around their average incomes, focusing on households with heads aged 44 to 49. She found that market income volatility increased significantly between 1968 and 1992, which is consistent with our results. Gosselin (2004) analyzed fluctuations in total income for households with heads aged 25 to 64. He reported that volatility rose in the 1970s, leveled out in the early 1980s, and climbed further in the late 1980s and early 1990s. The timing of these increases does not match our results exactly but is broadly similar. Hacker (2006) applied the Gottschalk-Moffitt decomposition to household income and argued that the transitory variance rose at a moderate pace in the 1970s and 1980s, surged in the early 1990s, and retraced part of that run-up by the early 2000s (page 2). All told, Hacker concluded that the volatility of pre-tax income tripled between the early 1970s and early 2000s (page 27); this increase in variance amounts to roughly a 75 percent increase in standard deviation, a much larger run-up than we find. In ongoing work refining his calculations, Hacker (2007) has estimated that transitory variance increased to a somewhat lesser extent, especially if extreme observations are trimmed. Winship (2007) argued that Hacker's (2006) estimates were unduly influenced by observations with reported family income below $4000, and that such observations

should be re-coded at $4000. With this modification, Winship estimated that income volatility increased a moderate amount between 1975 and 2000.

Using Current Population Survey (CPS) data, Hertz (2006) analyzed dollar (not percent) changes in households' incomes from one year to the next. He estimated that income volatility increased significantly between 1990-91 and 1997-98 and then rose further by 2003-04. Based also on the CPS, Bollinger and Zilliak (2007) showed that income volatility for households headed by women was stable in the 1980s and early 1990s but rose 60 percent between 1995 and 2004. Using data from the Survey of Income and Program Participation (SIPP), Bania and Leete (2007) studied monthly deviations in households' incomes from their average incomes. Focusing on low-income households, they estimated that volatility increased substantially between 1992 and 2003.

6. Volatility of Hours Worked and Earnings per Hour

Of the various components of income we study, household heads' labor earnings experienced the largest increase in volatility. We now investigate that rise more closely.

Decomposition of Rising Earnings Volatility for Household Heads

An individual's earnings during a year can be described as the product of hours worked and earnings per hour. Earnings and hours are collected in the PSID, and we use their ratio as our measure of earnings per hour. To be sure, this calculation transmits measurement error in earnings and hours directly to earnings per hour. However, measurement error distorts our conclusions only to the extent it has changed over time, and we have detected no changes except for the jump in reports of heads' earnings of zero and hours worked over 120; we continue to exclude those observations.

The volatility of annual hours worked by household heads (shown in the top left panel of figure 4) and earnings per hour (shown in the top right panel) both increased during the past three decades. However, the run-up in volatility was much more pronounced for earnings per hour. As listed in table 1, the standard deviation of hours rose 23 percent between the early 1970s and early 2000s, while the standard deviation of earnings per hour climbed 51 percent. Consistent with an escalating role for movements in earnings per hour, the bottom left panel displays the declining correlation between movements in earnings and hours.

Yet, the importance of volatility in hours worked should not be discounted. Hours were more volatile than earnings per hour for much of the last thirty years, and they were only a bit less volatile at the end of that period. In addition, the frequency of very large changes in hours worked, shown in the bottom right panel, increased, on net, between the early 1970s and early 2000s. As with very large income changes, very large hours declines are more common when the aggregate economy weakens, and very large hours increases are less common.

These results are suggestive, but hardly definitive, about the extent to which the upward trend in income volatility reflects voluntary versus involuntary factors. Changes in hours can be either voluntary—for example, as a worker chooses to cut back to a part-time job—or involuntary—for example, as a worker loses a full-time job and can find only a part-time new job. But changes in earnings per hour are more likely to be involuntary, because workers rarely choose to cut back on their hourly compensation rate. Thus, our finding that the volatility of earnings per hour rose more sharply than hours

worked implies that the increase in household heads' earnings volatility during the past thirty years likely had an important involuntary component.

Comparison with Previous Results on Volatility of Hours and Earnings per Hour

One contributing factor to changes in hours and earnings per hour is job turnover. Because people who lose jobs often do not find new jobs immediately, or find new jobs that pay less than their previous jobs, an increase in the pace of job loss or slowdown in the pace of finding comparable new jobs would tend to boost the volatility of both hours and earnings per hour. At the same time, many other factors also contribute to these types of volatility, so one should not expect a tight link between our results and previous results on the evolution of worker displacement.

Moreover, a sizable literature on the evolution of displacement has not reached a consensus. For example, using data from the Retirement History Survey, the National Longitudinal Study of Older Men, and the Health and Retirement Study, Stevens (2005) found that the prevalence of long-term employment relationships for men was stable between 1969 and 2002. But her analysis was limited to men born before 1944, so the broader relevance of this finding is unclear. Farber (2005, 2007a, and 2007b) estimated that job tenure declined sharply during the past several decades but noted the puzzle that rates of job loss as measured in the Displaced Workers Survey (DWS) did not increase over that period. He concluded that the DWS must miss important types of displacement, but this explanation remains to be proven. Farber further showed that the decline in tenure was concentrated among men, with long-term employment becoming slightly more common among women; this gender difference is consistent with our finding that

male earnings have become more volatile while female earnings have not, although of course other factors may matter much more.

A related set of papers examines changes in employment at the firm level. Comin and Philippon (2005) and Comin and Mulani (2006) used Compustat data on publicly traded firms to show that growth rates of firm employment have become more volatile during the past 35 years; indeed, Comin, Groshen, and Rabin aimed to link this rise in volatility to a rise in earnings instability for household heads. However, Davis, Haltiwanger, Jarmin, and Miranda (2006) argued that these results were distorted by changes over time in the selection of firms that are publicly traded. Using instead the Longitudinal Business Database that covers all firms, Davis et al found a significant decline in the volatility of firm-level employment growth.

One factor that may have contributed to the rise in volatility of earnings per hour is an apparent increase in the share of compensation that depends on worker performance. For example, Lemieux, Macleod, and Parent (2006) contended that changes in labor market institutions during the past several decades—including the decline in unionization, drop in the real minimum wage, and reduction in the cost of collecting and processing data on worker performance—have boosted the fraction of workers whose pay is linked to their performance. They showed that wages are more dispersed in performance-pay jobs than in other jobs, which would tend to make compensation both more unequal and more variable from year-to-year. Violante (2002) asserted that a speedup in the rate of technical change increases productivity differentials across vintages of machines and thus across workers with expertise using these machines. Under this view, the step-up in productivity growth during the past decade would tend to

raise both the inequality and variability of compensation. Note that a stronger link between pay and performance may help to stabilize hours worked. For example, Weitzman (1984) advocated an expansion of profit-sharing as a means of reducing the employment response to economic shocks.

7. Conclusion

The Great Moderation of aggregate economy activity has not shown through at the level of individual households. Instead, households face larger income changes—especially, a greater chance of very large changes in income—than they did several decades ago. Connecting these developments is a central goal of our ongoing research. In preliminary work (Dynan, Elmendorf, and Sichel, 2006b), we showed that aggregate income constructed from PSID data has become less volatile over time. We reconciled this finding with greater household-level volatility by documenting a decline in the covariance of income across households in various demographic groups.

We close by emphasizing that an increase in the *volatility* of household income does not imply a corresponding increase in the *risk* faced by households. First, only part of income variability reflects involuntary job loss and wage cuts, while part reflects voluntary choices such as deciding to leave the labor force. Our finding that the volatility of earnings per hour rose more sharply than hours worked suggests an important involuntary component to rising income variability, but much more analysis is needed.

Second, risk can arise from a variety of economic shocks besides the income variations we studied here. For example, leaving aside households whose heads are retired means that we did not learn anything about the volatility of pension benefits. By

restricting our analysis to households with the same head over time, we ducked part of the risk stemming from divorce. Because of limitations in the PSID data, we cannot study changes in taxes or non-monetary transfer payments. And we did not examine risks on the spending side, such as an unexpected need to pay for extra health care.

Third, shocks to income can be buffered to some extent by adjustments to saving and borrowing, thereby reducing their impact on consumption. In an earlier paper (2006a), we argued that financial innovation has enhanced households' access to credit over time and thus strengthened their ability to smooth consumption in the face of income shocks. Using aggregate data, we showed that consumer spending has become less sensitive in the past few decades to movements in contemporaneous income. In preliminary work using household data (2006b), we confirmed that spending has become less responsive to income shifts. In terms of people's well-being, an improvement in the ability to smooth consumption relative to income provides a partial counterweight to the increase in income volatility documented in this paper.

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Table 1
Three-Year Rolling Standard Deviations of Percent Changes

	1971	2004	Change	Percent Change
Labor earnings of household heads				
All observations	46	71	25	54
Excluding spurious observations	46	63	18	39
Labor earnings of spouses	101	84	-17	-16
Labor earnings of pooled heads and spouses				
All observations	75	72	-3	-3
Males	36	61	25	70
Females	96	81	-15	-15
Labor earnings combined for heads and spouses	44	56	12	28
Capital income of heads and spouses	105	114	9	9
Transfer income of heads and spouses	83	109	26	31
Household income				
All observations	35	47	12	36
No high school degree	40	54	15	38
High school but no college degree	32	47	15	48
College degree	31	45	14	44
Drop top and bottom 10 percent	18	22	4	23
Drop top and bottom 25 percent	9	10	1	11
Annual hours of household heads	42	51	9	23
Earnings per hour of household heads	37	56	19	51

Note. Uses two-year percent changes as described in text, with nominal values deflated by the CPI. Based on PSID representative sample excluding observations with household head under age 25, household head retired, household head changed from previous observation, and (for earnings) positive farm income. Imposes consistent top-coding and bottom-coding of levels.

Table 2
Selected Studies of Earnings and Income Volatility

Authors (Date)	Data	Measure of Volatility	Key Conclusions
Gottschalk and Moffitt (1994)	PSID; 1970 to 1987; white male household heads aged 20-59; wages and salaries	Variance of transitory earnings defined as gap between actual earnings and individual average earnings	Volatility of earnings rose between the 1970s and 1980s
Gottschalk and Moffitt (1995)	PSID; 1970 to 1987; white male household heads aged 20-59; wages and salaries	Variance of transitory earnings estimated using formal model of earnings dynamics	Volatility of earnings rose between the late 1960s and late 1980s
Daly and Duncan (1997)	PSID; 1969 to 1995; male household heads aged 25-44; labor earnings	Variance of transitory earnings and other measures	Volatility of earnings rose between the 1970s and 1980s
Dynarski and Gruber (1997)	PSID; 1970 to 1991; male household heads aged 20-59; labor earnings	Variance of transitory earnings defined as gap between actual earnings and individual earnings growth path	Volatility of earnings rose in the late 1970s and early 1980s
Cameron and Tracy (1998)	CPS; 1968 to 1997; men; wages and salaries	Variance of transitory earnings	Volatility of earnings rose in 1970s and early 1980s, and later retraced part of run-up
Gittleman and Joyce (1999)	PSID; 1968 to 1991; households; total income	Variance of transitory income estimated using formal model of income dynamics	Volatility of household income rose between 1970s and 1980s
Haider (2001)	PSID; 1968 to 1992; white male household heads aged 25-60; labor earnings	Variance of transitory earnings estimated using formal model of earnings dynamics	Volatility of earnings rose between early 1970s and late 1980s

Hyslop (2001)	PSID; 1979 to 1985; men and women aged 18-60; labor earnings	Variance of transitory earnings estimated using formal model of earnings dynamics	Volatility of earnings rose in 1980s
Moffitt and Gottschalk (2002)	PSID; 1970 to 1996; male household heads aged 20-59; wages and salaries	Variance of transitory earnings defined using decomposition and estimated using model	Volatility of earnings rose in early 1980s and early 1990s, and later retraced run-up
Batchelder (2003)	PSID; 1968 to 1992; households; market income	Variation in income around average income	Volatility of household income rose between 1968 and 1992
Gosselin (2004)	PSID; 1970 to 2000; households; total income	Fluctuations in income	Volatility of household income rose in 1970s and jumped in early 1990s
Hacker (2006)	PSID; 1970 to 2002; households headed by people aged 25-61; total income	Variance of transitory income defined using decomposition	Volatility of household income rose in 1970s and 1980s, surged in 1990s, and later retraced part of run-up
Comin, Groshen, and Rabin (2006)	PSID; 1970 to 1993; household heads; labor earnings	Variance of transitory earnings defined as gap between actual earnings and individual average earnings	Volatility of earnings rose between early 1970s and early 1990s
Gottschalk and Moffitt (2006)	PSID; 1970 to 2002; male household heads aged 20-59; wages and salaries	Variance of transitory earnings defined using decomposition and estimated using model	Volatility of earnings rose in 1970s, 1980s, 1990s, and early 2000s
Hertz (2006)	CPS; 1990 to 2004; households; income	Median absolute value of dollar changes in income	Volatility of household income rose between early 1990s and early 2000s
Winship (2007)	PSID; 1974 to 2000; households; total income	Variance of transitory income defined using decomposition	Volatility of household income rose between mid-1970s and 2000

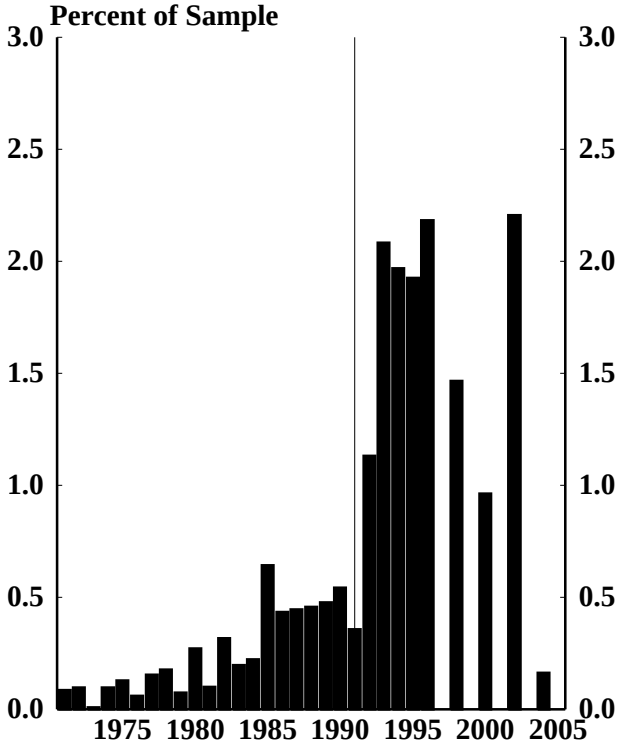
Bollinger and Ziliak (2007)	CPS; 1979 to 2004; households headed by women aged 16-54; total income	Variance of transitory income defined using decomposition	Volatility of household income was stable in 1980s and early 1990s, but rose between mid-1990s and early 2000s
Bania and Leete (2007)	SIPP; 1992 to 2003; low-income households; total income	Variation in monthly income around average income	Volatility of household income rose between early 1990s and early 2000s
Congressional Budget Office (2007)	CWHS; 1980 to 2003; men and women aged 22-59; labor earnings excl. self-employment	Percent changes in earnings	Volatility of earnings has changed little since 1980

Figure 1

Volatility of Real Individual Labor Earnings

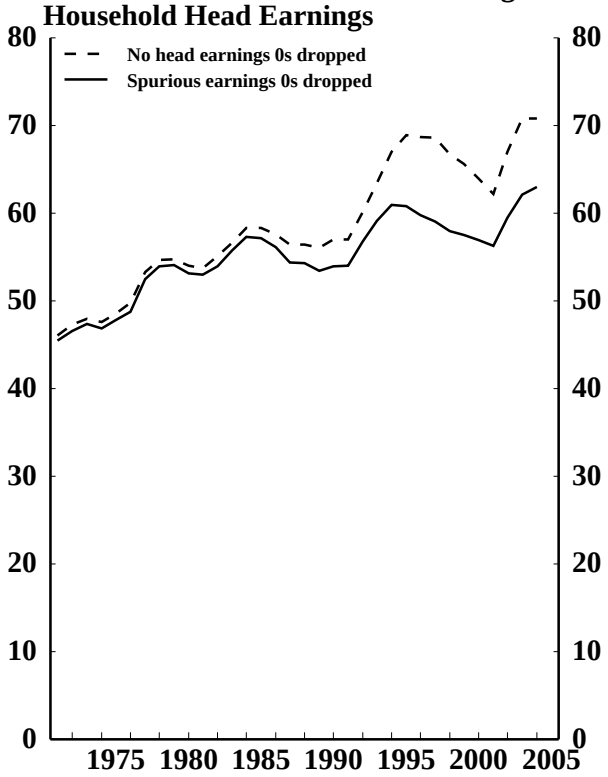
Nonfarm Representative Sample; 1971-2004

Head Labor Earnings = 0
Head Annual Hours > 120
Percent of Sample



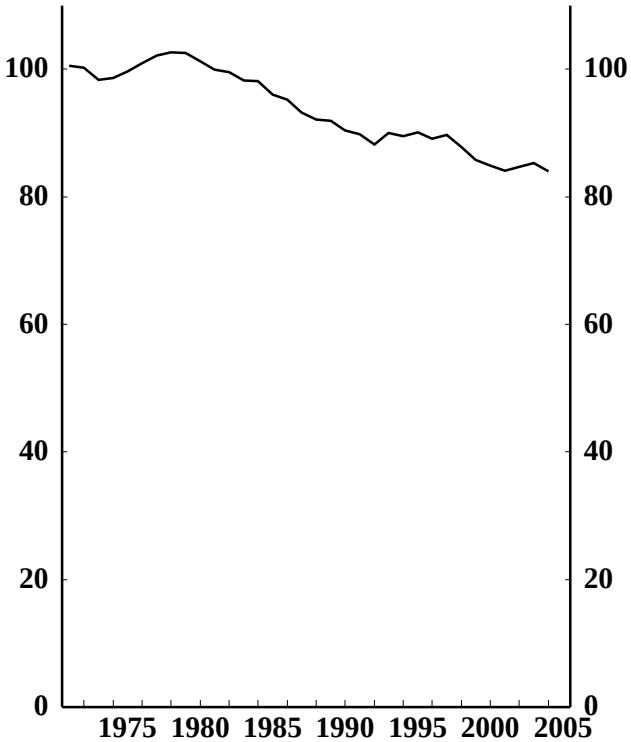
Note. Vertical line at 1991.

Standard Deviation of Percent Changes
Household Head Earnings



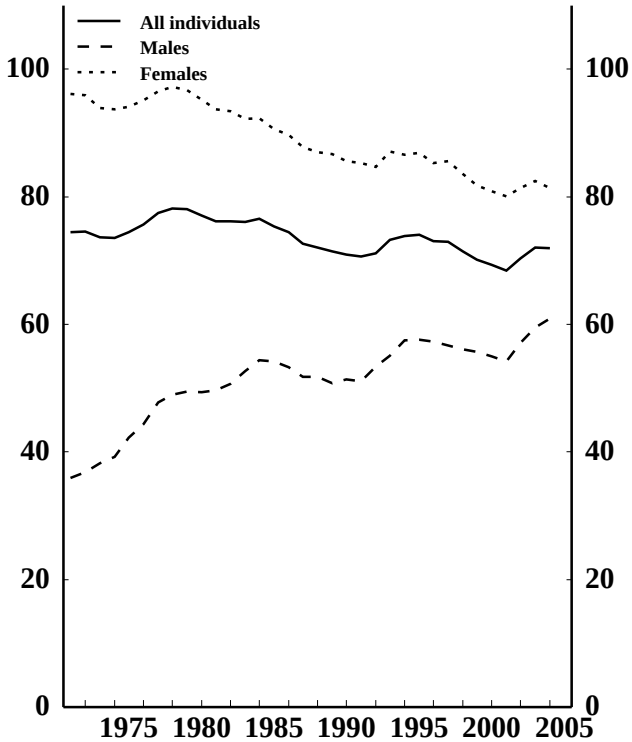
Note. 3-year moving averages of 2-year changes.

Standard Deviation of Percent Changes
Spouse Earnings



Note. 3-year moving averages of 2-year changes.

Standard Deviation of Percent Changes
Pooled Head and Spouse Earnings



Note. 3-year moving averages of 2-year changes.

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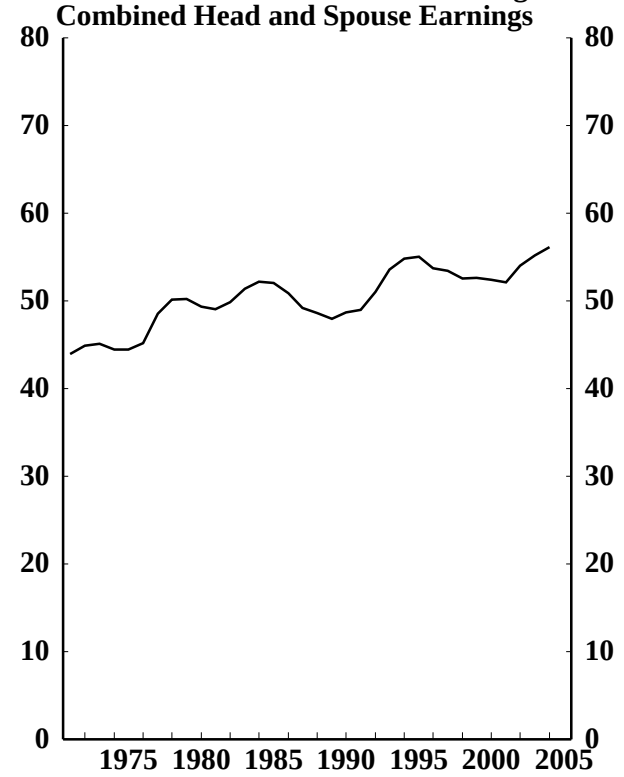
Figure 2

Volatility of Components of Real Household Income

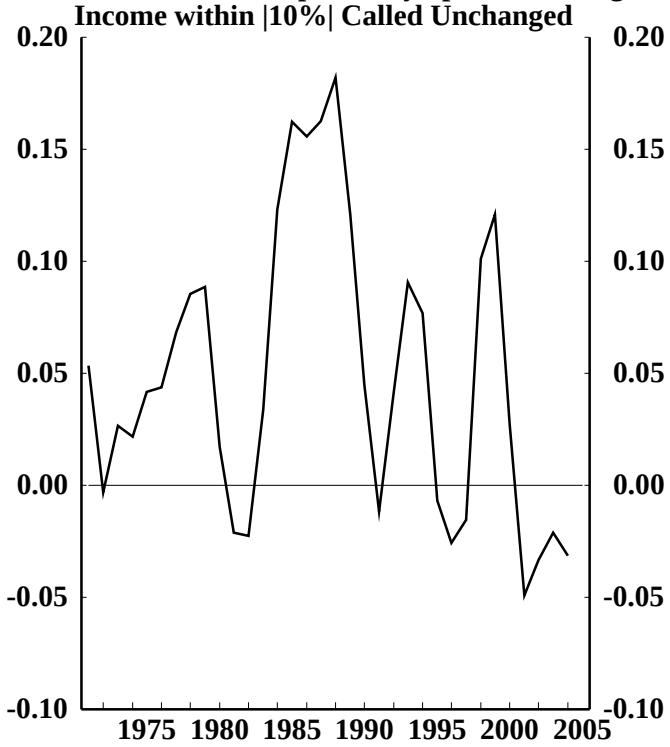
Representative Sample; 1971-2004

Standard Deviation of Percent Changes
Combined Head and Spouse Earnings



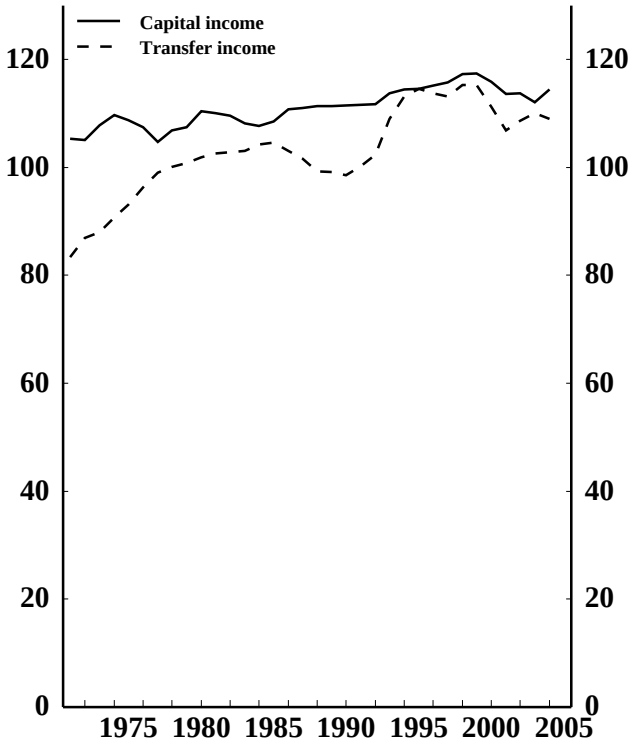
Note. Nonfarm sample; 3-year moving averages of 2-year changes.

Head Earnings Down
Mean Amount Replaced by Spouse Earnings
Income within |10%| Called Unchanged



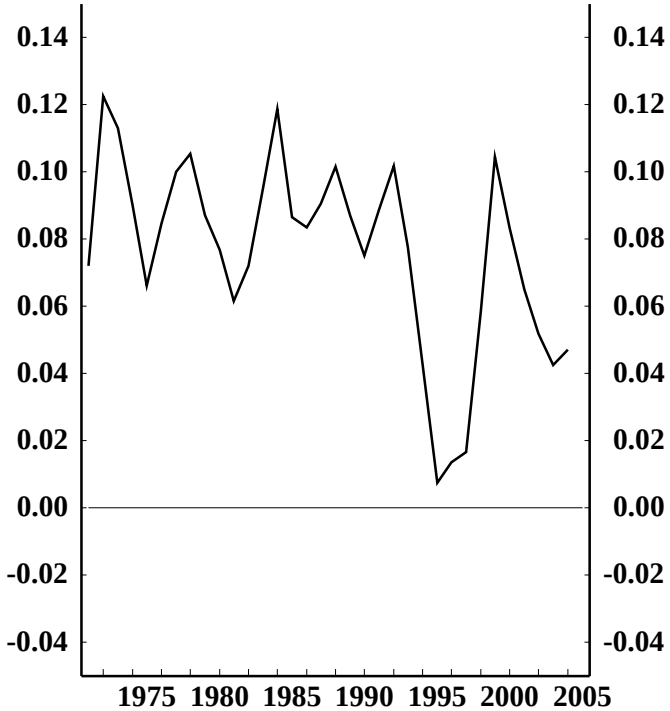
Note. Nonfarm sample; 3-year moving averages of 2-year changes.

Standard Deviation of Percent Changes
Head and Spouse Capital and Transfer Income



Note. 3-year moving averages of 2-year changes.

Market Income Down
Amount Replaced by Transfer Income
Income within |10%| Called Unchanged



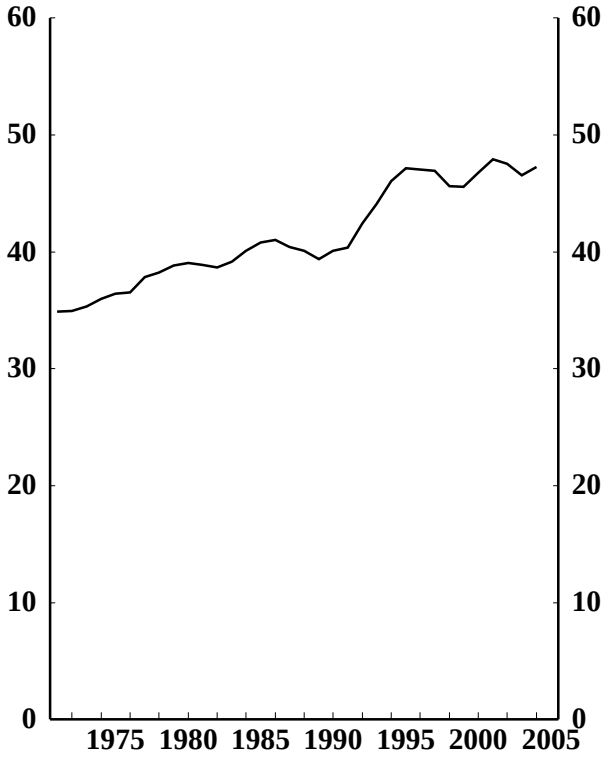
Note. 3-year moving averages of 2-year changes.

Figure 3

Volatility of Real Total Household Income

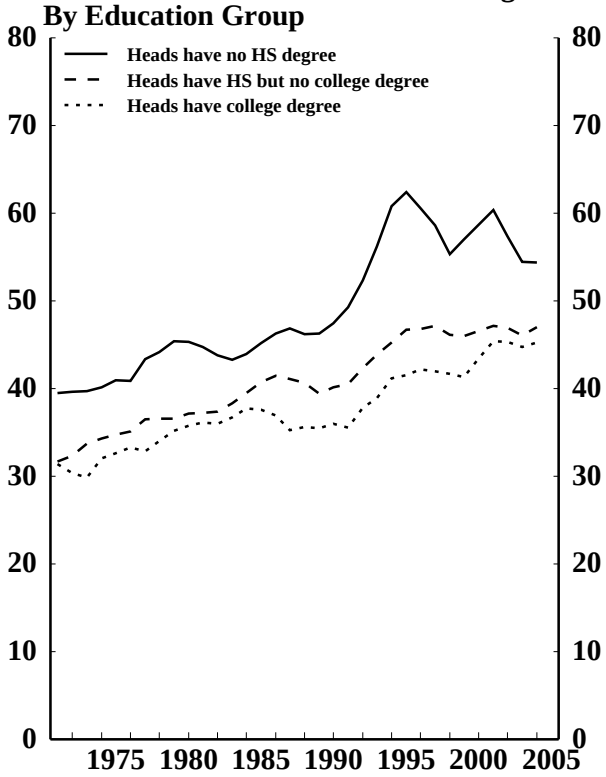
Representative Sample; 1971-2004

Standard Deviation of Percent Changes



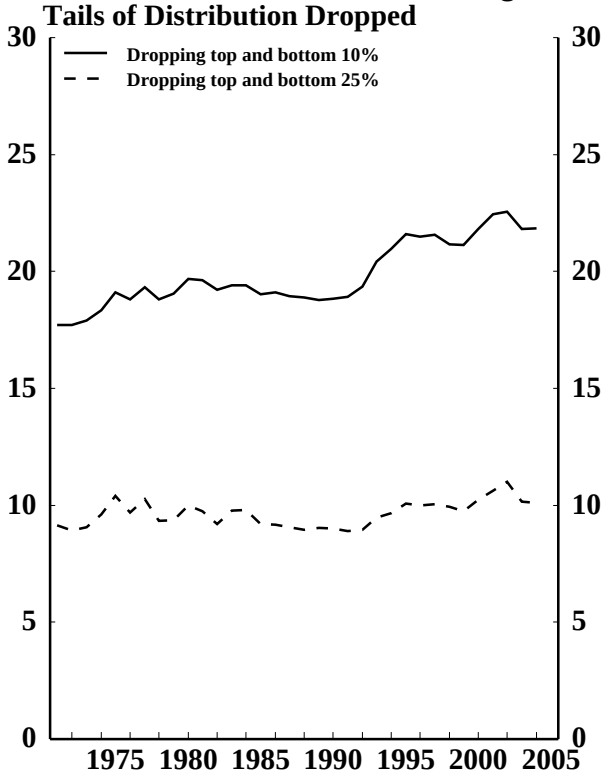
Note. 3-year moving averages of 2-year changes.

Standard Deviation of Percent Changes By Education Group



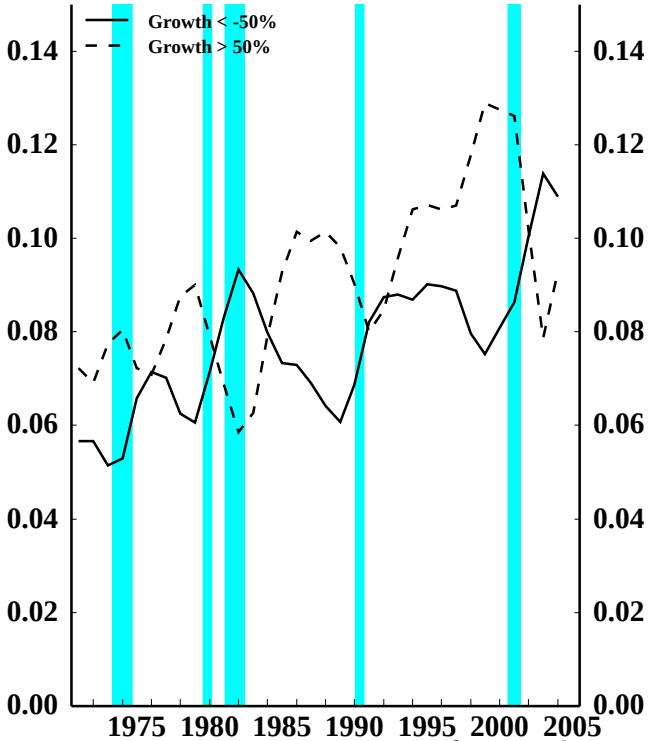
Note. 3-year moving averages of 2-year changes.

Standard Deviation of Percent Changes Tails of Distribution Dropped



Note. 3-year moving averages of 2-year changes.

Frequency of Large Declines and Increases



Note. 3-year moving averages of 2-year changes.
Shaded areas denote NBER recessions.

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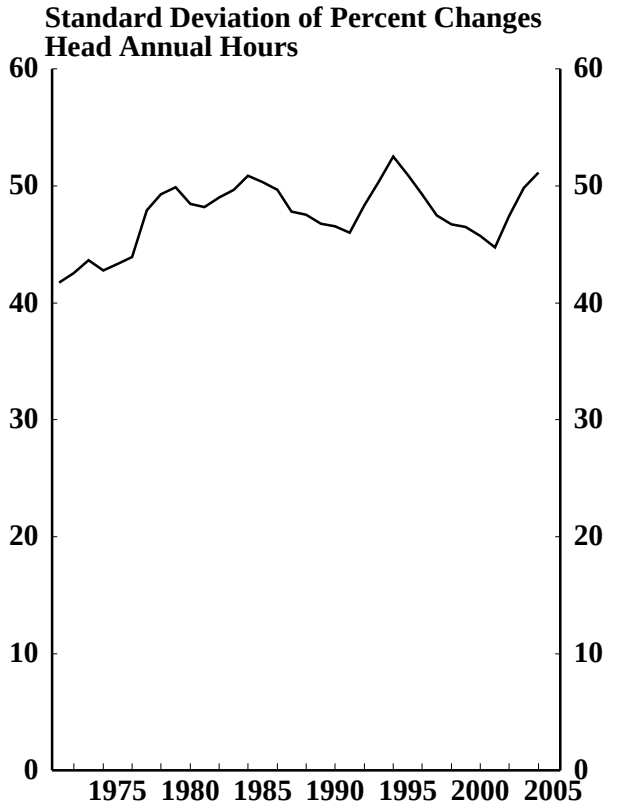
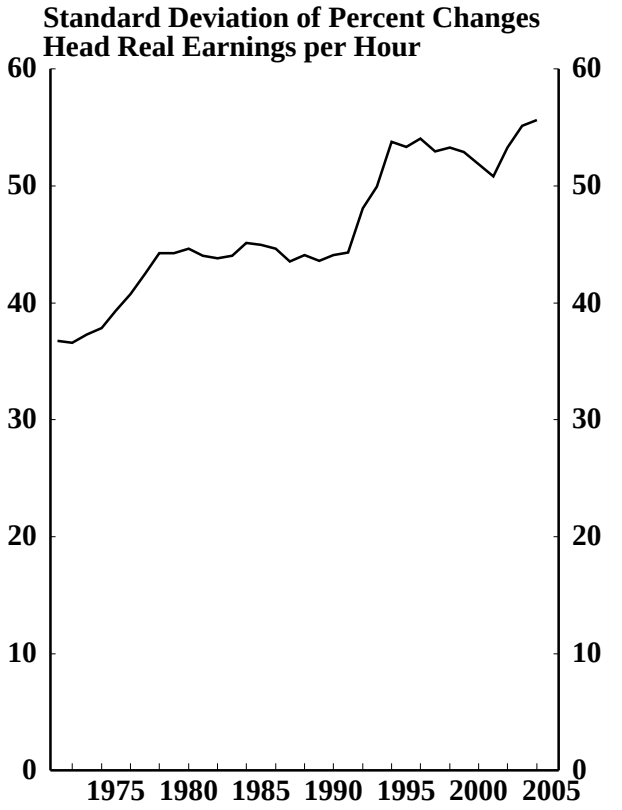
Figure 4

Volatility of Hours Worked and Earnings per Hour

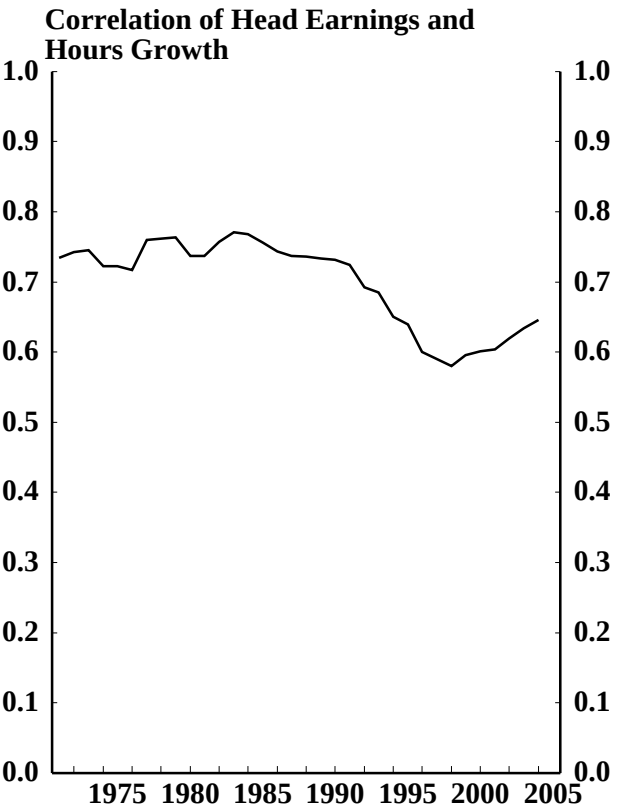
Nonfarm Representative Sample; 1971-2004



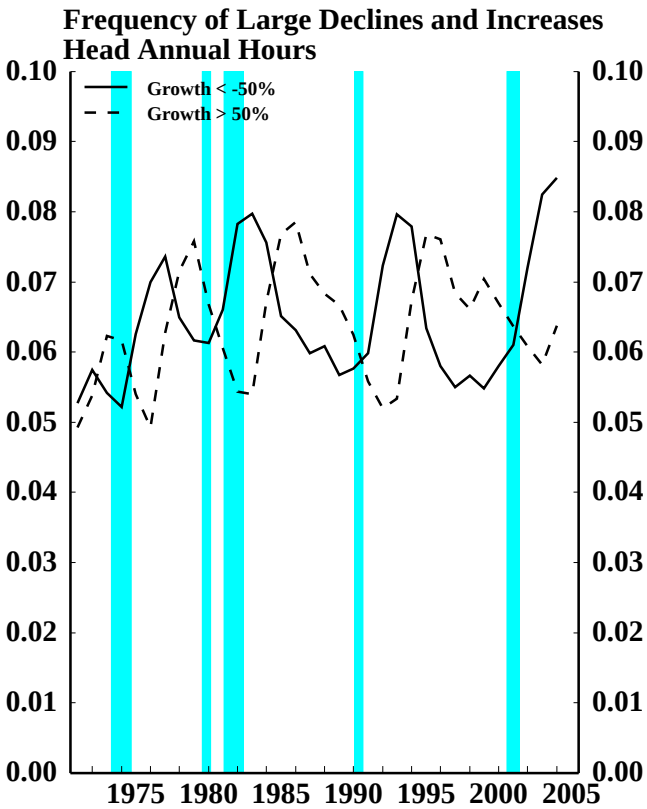
Note. 3-year moving averages of 2-year changes.



Note. 3-year moving averages of 2-year changes.



Note. 3-year moving averages.



Note. 3-year moving averages of 2-year changes.
Shaded areas denote NBER recessions.

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